CLAIMS

1. A method for generating a plasma as a source of radiation by irradiating a pulsed laser on material, wherein said material is a particle-cluster which consists of many particles coupled with each other by a molecular force, an electrical force, or a binder made of a material which vaporizes at temperature lower than the melting point of said particles.

2. The method according to claim 1, comprising a method of cracking the particle-cluster to disperse aggregating particles prior to plasma generation with a help of a thermal, electrical, or mechanical shock with heating by the irradiation of a laser, charged particle beam, or other means.

3. The method according to claim 1 or 2, wherein particles forming a particle-cluster are mixed in a liquid at room temperature or in a fluid which liquefies by cooling, thus prepared suspension is ejected to form a droplet, and a particle-cluster is formed by vaporization of a solvent which serves as a binder of particles.

4. The method according to claims 1 through 3, wherein liquid nitrogen, water, or organic solvent is employed as a solvent of the suspension liquid.

5. The method according to claim 3 or 4, wherein particles in the suspension liquid in a reservoir are uniformly distributed in order to reduce fluctuation of number of particles in a particle-cluster by controlling the potential of Hydrogen in the suspension liquid and/or by stirring the suspension or by other means.

6. The method according to claims 3 through 5, wherein a nozzle ejecting a suspension liquid is vibrated regularly for droplet generation.

7. The method according to claim 6, wherein a frequency of vibration is between 100 Hz and 1 MHz.

8. The method according to claim 6 or 7, wherein amplitude of vibration is larger than 1 μm.

9. The method according to claims 3 through 9, wherein vaporization or sublimation of a solvent of a droplet is performed in a separate space before delivering a droplet of a suspension to a plasma generation space.

10. The method according to claim 9, wherein vaporization or sublimation of a solvent of droplets is enhanced by heating droplets by laser irradiation or other means.

11. The method according to claims 1 through 10, comprising a method of charging a particle-cluster and a method of electrically controlling the trajectory of a particle-cluster.

12. The method according to claims 1 through 11, wherein particles constituting a particle-cluster is smaller than 1 μm in diameter.

13. The method according to claims 1 through 12, wherein particles constituting a particle-cluster contain tin, tin oxide, or other tin compounds.

14. The method according to claims 1 through 13, wherein total mass of particles constituting a particle-cluster is larger than that of a single particle with solid-state density having a diameter of 5 μm.

15. The method according to claims 1 through 14, wherein total mass of particles constituting a particle-cluster is smaller than that of a single particle with solid-state density having a diameter of 200 μm.

16. The method according to claim 1 through 15, wherein particles constituting a particle-cluster are generated by the laser ablation of a liquid target or a solid target which includes chemical element comprising said particles.

17. A method for generating a plasma as a source of radiation by irradiating a pulsed laser on material, wherein
generation of fine particles by irradiating a short pulse on a solid target or a liquid target is performed in the environment where a gas flows, and the generated particles are conveyed by the gas flow into a plasma generation space.

18. An apparatus for generating a plasma as a source of radiation by irradiating a pulsed laser on material, wherein
said material is a particle-cluster which consists of many particles coupled with each other by a molecular force, an electrical force, or a binder made of a material which vaporizes at temperature lower than the melting point of said particles.

19. The apparatus according to claim 18, comprising a method of cracking a particle-cluster to disperse aggregating particles prior to plasma generation with a help of a thermal, electrical, or mechanical shock with heating by the irradiation of a laser, charged particle beam, or other means.

20. The apparatus according to claim 18 or 19, wherein particles forming a particle-cluster are mixed in a material which is a fluid at room temperature or in a fluid which liquefies, thus prepared suspension is

ejected to form a droplet, and a particle-cluster is formed by vaporization of a solvent which serves as a binder of particles.

21. The apparatus according to claims 18 through 20, wherein liquid nitrogen, water, or organic solvent is employed as a solvent of the suspension liquid.

22. The apparatus according to claim 20 or 21, wherein particles in the suspension liquid in a reservoir are uniformly distributed in order to reduce fluctuation of number of particles in a particle-cluster by controlling the potential of Hydrogen of the suspension and/or by stirring the suspension.

23. The apparatus according to claims 20 through 22, wherein a nozzle ejecting a suspension liquid is vibrated regularly for stable plasma generation.

24. The apparatus according to claim 23, wherein a frequency of vibration is between 100 Hz and 1 MHz.

25. The apparatus according to claim 23 or 24, wherein amplitude of vibration is larger than 1 μm.

26. The apparatus according to claim 20 through 25, wherein vaporization or sublimation of a solvent of a droplet is performed in a separate space before delivery to a plasma generation space.

27. The apparatus according to claim 26, wherein vaporization or sublimation of solvent of droplets is enhanced by heating droplets by laser irradiation or other means.

28. The apparatus according to claims 18 through 27, comprising a method of charging a particle-cluster and a method of electrically controlling the trajectory of a particle-cluster.

29. The apparatus according to claims 18 through 28, wherein particles constituting a particle-cluster is smaller than 1 μm in diameter.

30. The apparatus according to claims 18 through 29, wherein particles constituting a particle-cluster contain tin, tin oxide, or other tin compounds.

31. The apparatus according to claims 18 through 30, wherein total mass of particles constituting a particle-cluster is larger than that of a single particle with solid-state density having a diameter of 5 μm.

32. The apparatus according to claims 18 through 31, wherein total mass of particles constituting a particle-cluster is smaller than that of a single particle with solid-state density having a diameter of 200 μm.

33. The apparatus according to claims 18 through 32, wherein particles constituting a particle-cluster are generated by the laser ablation of a liquid target or a solid target.

34. An apparatus for generating a plasma as a source of radiation by irradiating a pulsed laser on material, wherein
generation of small particles by irradiating a short pulse on a solid target or a liquid target is performed in the environment where a gas flows and the generated particles are conveyed by the gas flow into a plasma generation space.